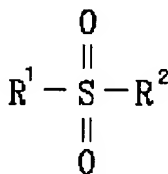


**WHAT IS CLAIMED IS:**

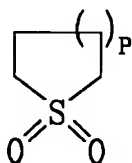
1. An electrolyte for a lithium battery, comprising a non-aqueous organic solvent, a lithium salt, and an additive comprising a) a sulfone-based compound; and b) a C<sub>3</sub> to C<sub>30</sub> organic peroxide or azo-based compound.

5           2. The electrolyte for a lithium battery according to claim 1, wherein the sulfone-based compound is represented by one of the following Formulas (1) to (3):



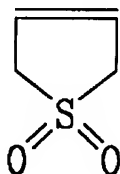
(1)

where R<sup>1</sup> and R<sup>2</sup> are independently selected from the group consisting of primary alkyl groups, secondary alkyl groups, tertiary alkyl groups, alkenyl groups, and aryl groups;



(2)

where p is from 0 to 3; and



(3).

15           3. The electrolyte for a lithium battery according to claim 2, wherein the sulfone-based compound is represented by Formula (1) wherein R<sup>1</sup> and R<sup>2</sup> are independently selected from C<sub>1</sub> to C<sub>4</sub> alkyl groups, C<sub>2</sub> to C<sub>4</sub> alkenyl groups and C<sub>6</sub> to C<sub>14</sub> aryl groups.

20           4. The electrolyte for a lithium battery according to claim 2, wherein the sulfone-based compound is selected from the group consisting of methyl sulfone, vinyl

sulfone, phenyl sulfone, benzyl sulfone, tetramethylene sulfone, butadiene sulfone, and mixtures thereof.

5        5.        The electrolyte for a lithium battery according to claim 1, wherein the sulfone-based compound is present in an amount of 0.001 to 10 wt% based on the total amount of electrolyte.

6.        The electrolyte for a lithium battery according to claim 1, wherein the organic peroxide or azo-based compound is present in an amount of 0.001 to 10 wt% based on the total amount of electrolyte.

10        7.        The electrolyte for a lithium battery according to claim 1, comprising an organic peroxide selected from the group consisting of isobutyl peroxide, lauroyl peroxide, benzoyl peroxide, m-toluoyl peroxide, t-butylperoxy-2-ethyl hexanoate, t-butyl peroxy bibarate, t-butyloxyneodecanate, diisopropyl peroxy dicarbonate, diethoxy peroxy dicarbonate, bis-(4-t-butylcyclohexyl)peroxy dicarbonate, dimethoxy isopropyl peroxy dicarbonate, dicyclohexylperoxy dicarbonate, 3,3,5-trimethylhexanoyl peroxide, and dialkyl oxide.

8.        The electrolyte for a lithium battery according to claim 1, comprising 2,2'-azobisisobutronitrile.

20        9.        The electrolyte for a lithium battery according to claim 1, wherein the electrolyte includes a poly(ester)(meth)acrylate or a polymer thereof and the poly(ester)(meth)acrylate is a polymer derived from a (polyester)polyol with at least three hydroxyl (-OH) groups, where a portion or all of the hydroxyl groups are substituted with a (meth)acrylic ester and any remaining hydroxyl groups that are not substituted with the (meth)acrylic ester are substituted with a group having no radical reactivity.

25        10.       The electrolyte for a lithium battery according to claim 1, wherein the lithium salt is at least one selected from the group consisting of  $\text{LiPF}_6$ ,  $\text{LiBF}_4$ ,  $\text{LiSbF}_6$ ,  $\text{LiAsF}_6$ ,  $\text{LiClO}_4$ ,  $\text{LiCF}_3\text{SO}_3$ ,  $\text{Li}(\text{CF}_3\text{SO}_2)_2\text{N}$ ,  $\text{LiC}_4\text{F}_9\text{SO}_3$ ,  $\text{LiSbF}_6$ ,  $\text{LiAlO}_4$ ,  $\text{LiAlCl}_4$ ,  $\text{LiN}(\text{C}_x\text{F}_{2x+1}\text{SO}_2)(\text{C}_y\text{F}_{2y+1}\text{SO}_2)$ , wherein x and y are natural numbers,  $\text{LiCl}$ , and  $\text{LiI}$ .

11. The electrolyte for a lithium battery according to claim 10, wherein the lithium salt is present in a concentration ranging from 0.6 to 2.0 M,

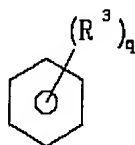
12. The electrolyte for a lithium battery according to claim 1, wherein the non-aqueous organic solvent is at least one selected from the group consisting of carbonates, esters, ethers, and ketones.

13. The electrolyte for a lithium battery according to claim 12, wherein the non-aqueous organic solvent comprises at least one carbonate selected from the group consisting of dimethyl carbonate (DMC), diethyl carbonate (DEC), dipropyl carbonate (DPC), methylpropyl carbonate (MPC), ethylpropyl carbonate (EPC), methylethyl carbonate (MEC), ethylene carbonate (EC), propylene carbonate (PC), and butylene carbonate (BC).

14. The electrolyte for a lithium battery according to claim 1, wherein the electrolyte comprises a mixed solvent of a cyclic carbonate and a chain carbonate.

15. The electrolyte for a lithium battery according to claim 1, wherein the electrolyte comprises a mixed solvent of a carbonate solvent and an aromatic hydrocarbon solvent.

16. The electrolyte for a lithium battery according to claim 15, wherein the aromatic hydrocarbon solvent is a compound of Formula (6):



wherein  $R^3$  is a halogen or a  $C_1$  to  $C_{10}$  alkyl, and  $q$  is an integer of 1 to 6.

17. The electrolyte for a lithium battery according to claim 16, wherein the aromatic hydrocarbon solvent is at least one selected from the group consisting of benzene, chlorobenzene, nitrobenzene, fluorobenzene, toluene, trifluorotoluene, and xylene.

18. The electrolyte for a lithium battery according to claim 15, wherein the carbonate solvent and the aromatic hydrocarbon solvent are mixed in a volume ratio of 1:1 to 30:1.

19. The electrolyte for a lithium battery according to claim 15, wherein the electrolyte comprises a mixed solvent of an ethylene carbonate and a carbonate having a lower boiling point.

20. An electrolyte for a lithium battery, comprising a non-aqueous organic solvent, a lithium salt, and an additive comprising a) a sulfone-based compound; b) a C<sub>3</sub> to C<sub>30</sub> organic peroxide or azo-based compound; and c) a poly(ester)(meth)acrylate or a polymer thereof,

wherein the poly(ester)(meth)acrylate is a polymer derived from a (polyester)polyol with at least three hydroxyl (-OH) groups, where a portion or all of the hydroxyl groups are substituted with a (meth)acrylic ester and any remaining hydroxyl groups that are not substituted with the (meth)acrylic ester are substituted with a group having no radical reactivity.

21. The electrolyte for a lithium battery according to claim 20, wherein the poly(ester)(meth)acrylate or polymer thereof is present in an amount of 0.001 to 30 wt% based on the total amount of electrolyte.

22. The electrolyte for a lithium battery according to claim 20, comprising a (polyester)polyol selected from the group consisting of trialkylols, glycerols, and erythritols.

23. The electrolyte for a lithium battery according to claim 20, comprising a (meth)acrylic ester represented by  $-OC(=O)(CH_2)_nOC(=O)CH=CH_2$  or  $-OC(=O)(CH_2)_nOC(=O)C(CH_3)=CH_2$ , where n is an integer of 1 to 20.

24. The electrolyte for a lithium battery according to claim 20, wherein the group having no radical reactivity is selected from the group consisting of C<sub>1</sub> to C<sub>20</sub> aliphatic hydrocarbons, C<sub>5</sub> to C<sub>20</sub> aromatic hydrocarbons, C<sub>1</sub> to C<sub>20</sub> ethers, and C<sub>1</sub> to C<sub>20</sub> esters.

25. The electrolyte for a lithium battery according to claim 20, wherein the group having no radical reactivity is selected from the group consisting of  $-\text{OC}(=\text{O})(\text{CH}_2)_3\text{CH}_3$ ,  $-\text{OC}(=\text{O})\text{Ar}$ , wherein Ar is an unsubstituted or substituted aromatic hydrocarbon,  $-\text{OC}(=\text{O})(\text{CH}_2)_n\text{O}(\text{CH}_2)_n\text{CH}_3$ , wherein n is an integer ranging from 1 to 20, -  
 5  $\text{O}(\text{C}=\text{O})(\text{CH}_2)_n\text{OC}(=\text{O})(\text{CH}_2)_n\text{CH}_3$ , wherein n is an integer ranging from 1 to 20, and -  
 $(\text{C}=\text{O})\text{CH}=\text{CH}_2$ .

26. The electrolyte for a lithium battery according to claim 20, wherein the (meth)acrylic ester and the group having no radical reactivity are present in a mole ratio of 1:0.01 to 1:100.

27. A method for preparing an electrolyte for a lithium battery, comprising:  
 adding a) a sulfone-based compound; b) a  $\text{C}_3$  to  $\text{C}_{30}$  organic peroxide or azo-  
 based compound; and c) a poly(ester)(meth)acrylate or a polymer thereof to a lithium  
 salt-containing organic solution to prepare a composition for a polymer electrolyte,  
 15 wherein the poly(ester)(meth)acrylate is a polymer derived from a (polyester)polyol with  
 at least three hydroxyl ( $-\text{OH}$ ) groups, where a portion or all of the hydroxyl groups are  
 substituted with a (meth)acrylic ester and any remaining hydroxyl groups that are not  
 substituted with the (meth)acrylic ester are substituted with a group having no radical  
 reactivity, and

20 impregnating or coating the composition for a polymer electrolyte on a current  
 collector to prepare a solid polymer electrolyte.

28. The method for preparing an electrolyte for a lithium battery according  
 to claim 27, wherein the method further comprises heat-treating or UV-radiating the  
 solid polymer electrolyte to polymerize the poly(ester)(meth)acrylate or the polymer of a  
 25 poly(ester)(meth)acrylate.

29. The method for preparing an electrolyte for a lithium battery according to  
 claim 27, wherein the composition for a polymer electrolyte further comprises a base  
 catalyst.

30. The method for preparing an electrolyte for a lithium battery according to claim 27, wherein the heat treating is performed at 40°C to 110°C .

31. A lithium battery comprising:

5 a positive electrode including a material that is capable of reversible intercalation/deintercalation of lithium ions, or a material that is capable of reversibly forming a lithium-containing compound as a positive active material;

a negative electrode including a lithium metal, a lithium-containing alloy, or a material that is capable of reversible intercalation/deintercalation of lithium ions; and

an electrolyte of claim 1.

10 32. The lithium battery according to claim 31, wherein the positive electrode includes a lithium-nickel-based or a lithium-nickel-manganese-based oxide.

33. The lithium battery according to claim 31, wherein the negative electrode includes a carbonaceous material having a d002 interplanar distance of about 3.35 to about 3.38.

15 34. The lithium battery according to claim 31, wherein the negative electrode includes a carbonaceous material having an Lc (crystallite size) measured by X-ray diffraction of more than 20nm.